for
Microplates ó Well

# Bottom
Elevation
*Mike Shanler 04/09/09*

Secretariat
Society for Laboratory Automation and Screening

# Contents

## Foreword

As early as the first meeting of the Society for Biomolecular Screening (SBS) in 1995, a need for clearly defined dimensional standards of a microtiter plate (or microplate) were identified. At the time, the microplate was already becoming an essential tool used in drug discovery research. The concept of a microplate was similar among manufacturers, but the dimensions and nomenclatures for microplates were different and confusing for microplate vendors, instrumentation companies, and end-users. This often caused numerous problems when microplates were used on robotics or in automated laboratory instrumentation. Published standards have since been proposed by the SBS Microplate Standards Development Committee (MSDC) Special Interest Group (SIG) and approved by the American National Standards Institute (ANSI).

In July of 2010, SBS merged with The Association for Laboratory Automation (ALA) to form The Society for Laboratory Automation and Screening (SLAS).

Suggestions for improvement of this standard are welcome. They should be sent to the Microplate Standards Development Committee of the Society for Laboratory Automation and Screening, 100 Illinois Street, Ste 242, St. Charles, Illinois 60174.

This *standard was processed and approved* for submittal to ANSI by the Microplate Standards Development Committee Consensus Body of the Society for Biomolecular Scrience (now known as the Society of Laboratory Automation and Screening). Committee approval of this standard does not necessarily imply that all committee members voted for its approval. At the time it approved this standard, the committee had the following member organizations:

*Michael Shanler, SLAS (formerly SBS) MSDC SIG Co-chair*
*Amer El-Hage, SLAS (formerly SBS) MSDC SIG Co-Chair*

*Organizations Represented: Aurora Biosciences, Astra Zeneca, BD Biosciences, Beeston Engineering, Corning Greiner Bio One, Labcyte, Merck, MDS, Perkin Elmer, Seahorse Labware, Tecan, ThermoFisher*

*Interest Groups:*
  1- *Manufacturers of microplates (n=5)*
  2- *Manufacturers of Instruments that use microplates (n=5)*
  3- *Users of microplates (n=3)*

# 1       Scope and purpose

## 1.1      Scope
This standard defines well bottom elevation of a microplate as specified in American National Standards Institute (ANSI) covering microplates with flat well bottoms.

## 1.2      Purpose
It is the purpose of this standard to describe the definitions of well bottom elevation and well bottom elevation variation. This standard also outlines the conditions required for making necessary measurements. Deviations from these conditions are permissible, provided that the methods used give results in substantial agreement with the methods given herein.

# 2       Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this American National Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this American National Standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below.

ASME Y14.5M-1994*, Dimensioning and Tolerancing*
ANSI/SLAS 2-2004 *(formerly ANSI/SBS 2-2004)* Height Dimensions for Microplates
ANSI/SLAS 4-2004 *(formerly ANSI/SBS 4-2004)* Well Positions for Microplates

# 3       Definitions

There are many terms and definitions associated with microplates that have special meaning to the industry. The following are definitions of terms used in this document:

**3.1 ASME:** Abbreviation for the American Society of Mechanical Engineers

**3.2 ANSI:** Abbreviation for the American National Standards Institute, Inc.

**3.3 SBS:** Abbreviation for the Society for Biomolecular Science.

**3.4 SLAS**: Abbreviation for the Society for Laboratory Automation and Screening.

**3.5 SBS Well Location:** Is the coordinates of the well location as defined in ANSI/SLAS 4-2004 *(formerly ANSI/SBS 4-2004) Well Positions for Microplates*

**3.6 Well Bottom Elevation (WBE):** Is the distance from Datum -A- to the inside bottom surface of any well at the **SBS Well Location**. It is reported as a nominal value with a tolerance   **(See Figure 1.)**

**3.7 Well Bottom Elevation Variation (WBEV):** is the Maximum allowable spread between the highest and lowest WBE points on an individual plate**.** It is reported as a maximum value. **(See Figure 2.)**

**3.8 Intra-Well Bottom Elevation Variation (IWBEV):** Is the range (maximum-minimum) of the distance from Datum óA- to anywhere on the inside bottom surface of any individual well. It is reported as a maximum value **(See Figure 3.)**

**3.9 Well Depth:** Is the distance from the maximum projection of any individual well to anywhere on the inside bottom surface of the well. It is reported as a nominal value with a tolerance **(See Figure 4.)**

**3.10 Bottom Thickness:** Is the mean thickness of all the well bottoms on any individual plate. It is reported as a nominal value. **(See Figure 4.)**

**3.11 Well Bottom Width:** Is the internal dimension (width or diameter) of any individual flat bottom well, measured at the inside bottom surface. It is measured to the theoretical sharp corner (to the tangency between the well⌀s inside bottom surface and the sidewalls). It is reported as a nominal value (**See Figure 4.**)

**3.12 Max Projection:** Is defined in: ANSI/SLAS 2-2004 *(formerly ANSI/SBS 2-2004) Height Dimensions for Microplates***(See Figure 5.)**

**3.13 Plate Heigh**t: Is defined in ANSI/SLAS 2-2004 *(formerly ANSI/SBS 2-2004) Height Dimensions for Microplates.* **(See Figure 5.)**

**3.14 Minimum Externa**l **Clearance to Plate Bottom:** Is defined in ANSI/SLAS 2-2004 *(formerly ANSI/SBS 2-2004) Height Dimensions forMicroplates.* **(See Figure 5.)**
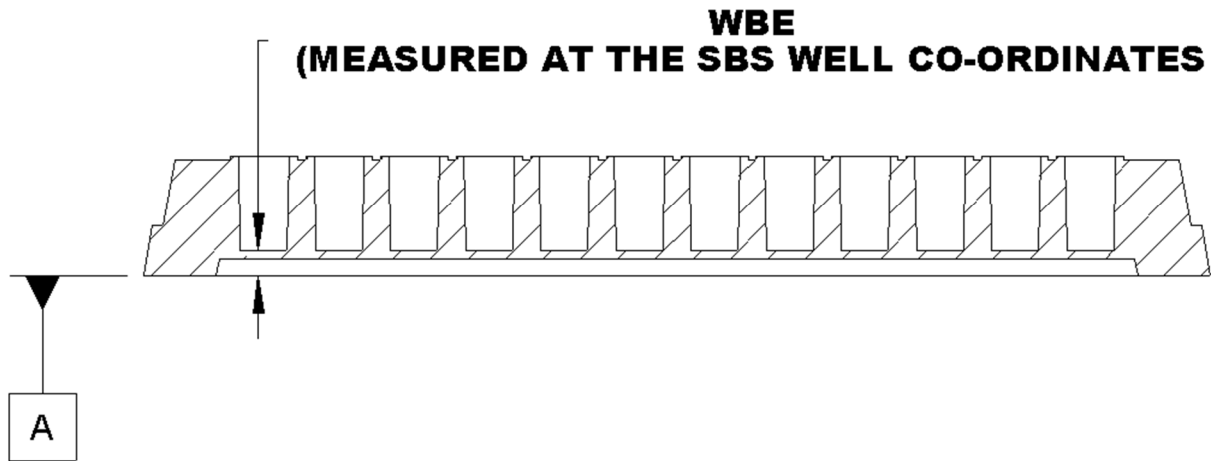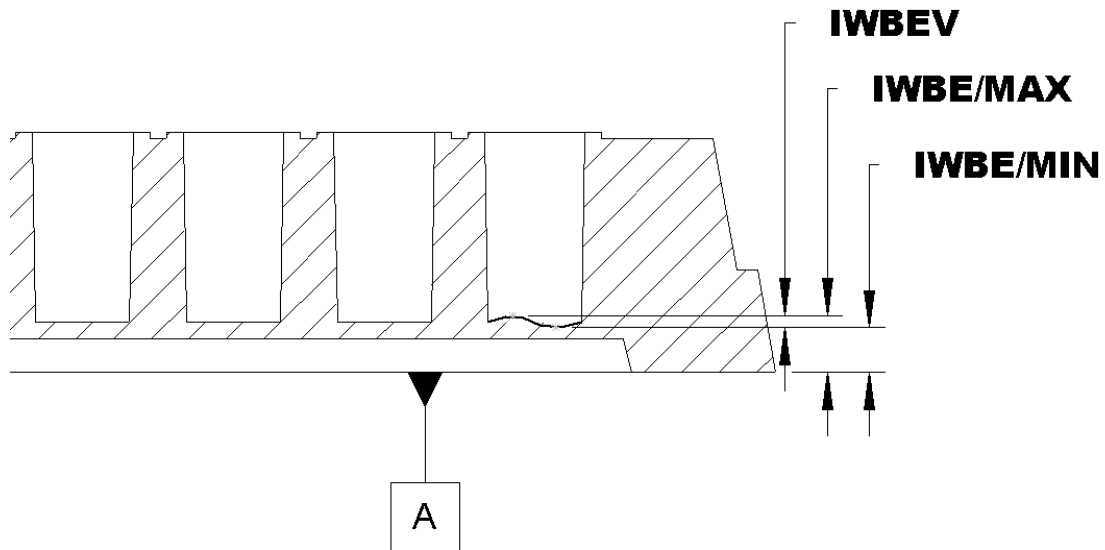


**Figure 1.**
Well Bottom Elevation (WBE)
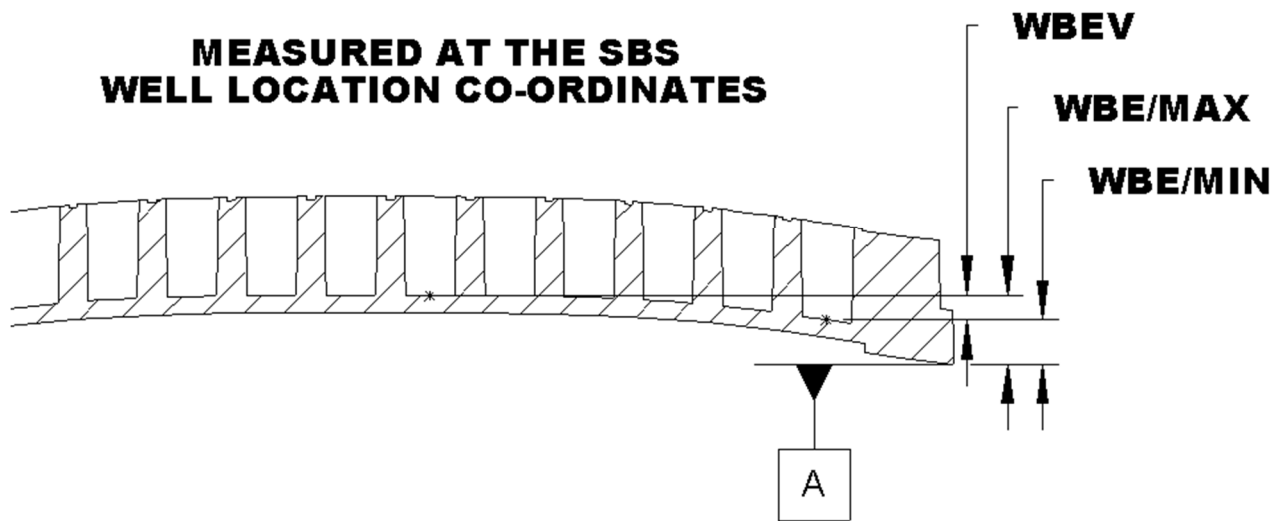


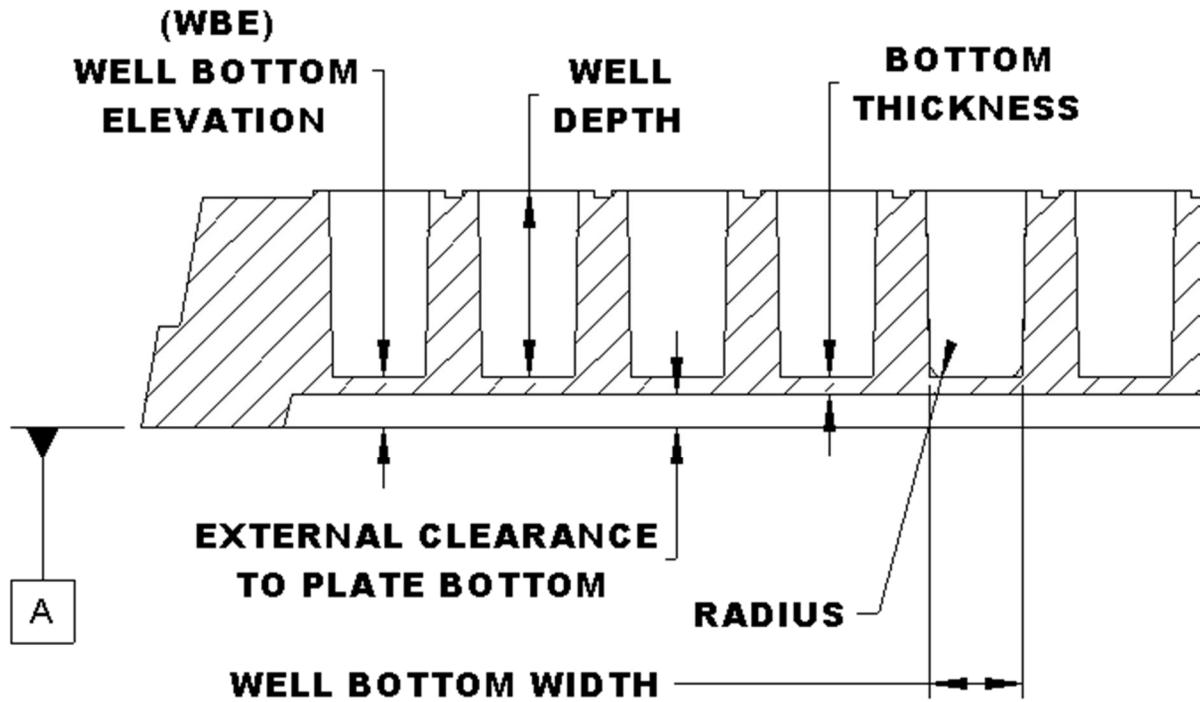**Figure 2**
Well Bottom Elevation Variation (WBEV),

(WBE/MAX minus WBE/MIN)

**MEASURED ACROSS THE
BOTTOM OF EACH WELL**



IWBEV

IWBE/MAX

IWBE/MIN

A

**Figure 3.**
Intra-Well Bottom Elevation Variation (IWBEV)

**MEASURED AT THE SBS WELL LOCATION CO-ORDINATES
(WBE)**



WELL BOTTOM
ELEVATION

WELL
DEPTH

BOTTOM
THICKNESS

EXTERNAL CLEARANCE
TO PLATE BOTTOM

RADIUS

WELL BOTTOM WIDTH

A

**Figure 4.**
WBE, Well Depth, Bottom Thickness, External Clearance, Well Bottom Width
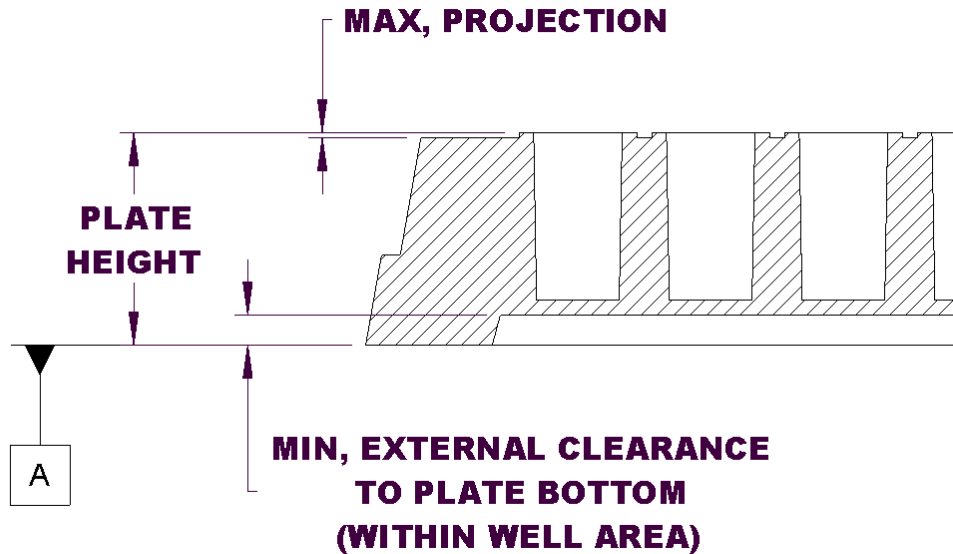
**Figure 5.**
Plate Height & External Clearance to the Plate Bottom

## 4　　Equipment

The equipment to be used for testing may be any combination of components that will measure the distance necessary within the stated accuracy and precision, without causing significant displacement or distortion of the microplate. It may consist of a Coordinate Measuring Machine and fixture to hold the microplate under test or it may consist of a custom test apparatus or set up.

## 5　　Test Set Up

**5.1　　Repeatability and Reproducibility, Accuracy**
5.1.1　　Repeatability and Reproducibility of the test set up shall be established.
5.1.2　　Accuracy to be established via calibration of the individual measuring tools or as an entire system.

**5.2　　Temperature**
5.2.1　　The parts and equipment shall be conditioned to the test temperature until stable.
5.2.2　　The test shall be conducted at $25^{o}C$ +/-$2^{o}C$

**5.3　　Part History**
5.3.1　　The parts to be tested shall be in the as manufactured condition as processed and packaged for delivery to the customer with no other history of heat cycling etc.

**5.4　　Force and Displacement**
5.4.1　　Consideration must be given to the nature of the part being measured such that the test setup does not distorted or displace the part in any significant way during measurement.
5.4.2　　Significance is defined as ŏGreater than 10% of the  part tolerance.

**5.5　　Alignment**
5.5.1　　The measurement of the well bottom surfaces shall be perpendicular to datum -A-.

# 6        Test Procedure

This test provides a method for determining microplate Well Bottom Elevation data through the measurement of the distance from Datum -A- to the inside bottom surface of each well.

## 6.1  Measure Part

6.1.1     Position the plate to be tested with datum -A- down. *Note:  Do not constrain the part flat to Datum –A-.*
6.1.2     Establish datums -B-C- and -D-E-.
6.1.3     Set zero-zero-zero at datum intersections.
6.1.4     Establish position based on the well co-ordinates.
6.1.5     Measure and record the distance from datum -A- to the inside bottom surface of the well.
6.1.6     Repeat for each additional well

## 6.2        Record Values

6.2.1     Calculate and record the WBE (the average value of all wells)
6.2.2     Determine and record the WBE/MAX (for each plate and the maximum value of all plates)
6.2.3     Determine and record the WBE/MIN (for each plate and the minimum value of all plates)
6.2.4     Calculate and record WBEV for each plate (the range of all well values on each plate)
6.2.5     Determine and record the IWBE/MAX (the maximum value of each well)
6.2.6     Determine and record the IWBE/MIN (the minimum value of each well)
6.2.7     Calculate and record IWBEV (the range of each well)


# 7        Limits

This standard specifies definitions and a test method only.  It is not the intent of this standard to state a limit for Microplate Well Bottom Elevation (WBE), Well Bottom Elevation Variation (WBEV), or Intra-Well Bottom Elevation Variation (IWBEV). Results should be reported as having been obtained using the described protocols. The requirements for instruments that use microplates should specify WBE, WBEV and/or IWBEV with respect to the described protocols.
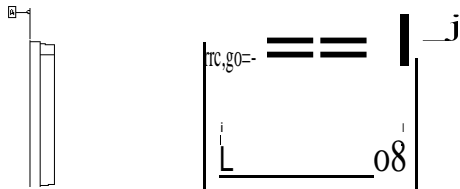
# Annex

## Annex A- Datum
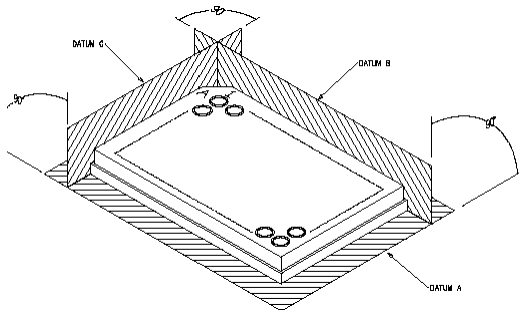
### A.l    Specifying datum features

PER ASME Y14.5M-1994
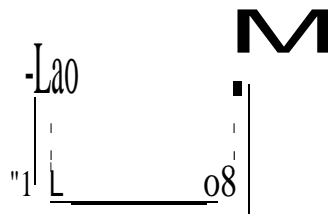
PARAGRAPH 4.41

THIS ON THE DRAWING:



MEANS THIS:



### A.2    Specifying composite datums

PER ASME Y14.5M-1994

PARAGRAPH 1.73, 4.5.10, 6.3.1.2

THIS 01 THE DR/WIING:



MEANS THIS: